

2008 Wetland Restoration Monitoring Report

Raytheon Company

Former Raytheon Facility
430 Boston Post Road
Wayland, Massachusetts

MADEP File No. 322-0647

29 January 2009

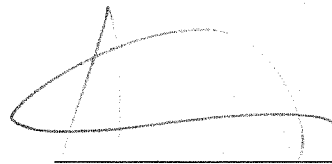
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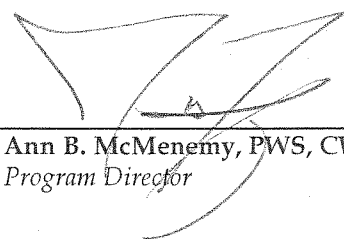
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MADEP File #322-0647
ERM Reference: 0079387



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On behalf of Raytheon Company (Raytheon), Environmental Resources Management (ERM) has prepared this 2008 Wetland Restoration Monitoring Report to present results of the first year of monitoring for the Northern Area wetland at the Former Raytheon Facility at 430 Boston Post Road in Wayland, Massachusetts (Site) as required by the Order of Conditions issued 8 August 2006 (DEP file 322-0647). A Site locus map and Site plan are provided as Figure 1 and Figure 2, respectively.

The project involved restoring an approximately 1,339 square foot (ft²) area by re-establishing the hydrology, topography, and the scrub-shrub plant community of this linear drainage feature disturbed by the excavation of volatile organic compound-impacted soils in the adjacent buffer zone (ERM, 2006a). While construction activities only impacted approximately 543 ft² of wetland, wetland impacts were mitigated through restoration at a 1:2.4 ratio, resulting in approximately 1,339 ft² of wetland restoration area (ERM, 2008). A Restoration Plan dated 14 June 2006 (ERM, 2006b) was submitted to the Town of Wayland Conservation Commission (Commission) to provide specifications for restoring the wetland and accepted through the issuance of the Order of Conditions. The construction and plant installation was completed by 5 October 2007.

The planting regime in the restored wetland area mimicked the pre-existing native vegetative cover. No trees or saplings were present in the disturbed wetland; therefore, the restoration area was planted with a mix of four shrubs and an herbaceous layer of sensitive fern. Planted stock was purchased from Bigelow Nurseries of Northborough, Massachusetts. A summary of planted stock is provided in Table 1. The wetland restoration area was also seeded with a native seed mix, Wet Detention Basin and Moist Site Mix, prepared by New England Wetland Plants (NEWP). The buffer zone was seeded using NEWP New England Dry Site Mix.

In accordance with the 8 August 2006 Order of Conditions (OOC) (Commission, 2006), wetland monitoring will be conducted for 2 years subsequent to the completion of construction. This report summarizes the results of the monitoring conducted after one full growing season.

2.0 2008 MONITORING RESULTS

2.1 STANDARDS FOR SUCCESS

The OOC issued to conduct the remediation and restoration established standards for success to ensure that the project could be objectively evaluated to determine whether the restoration area was developing into the desired resource type and providing the expected functions. The OOC requires the survival of 90 percent of the planted stock in the restoration area after two full growing seasons. In addition, the Massachusetts Wetlands Protection Act (MWPA) requires at least 75 percent coverage of native wetland species after two growing seasons. The first year of monitoring indicates that 100 percent of the planted stock is thriving, the area is 100 percent vegetated, and the restoration area has become a functional scrub-shrub wetland that provides valuable wildlife habitat and flood storage.

2.2 2008 SUMMARY DATA

ERM wetland scientists conducted wetland monitoring on 1 August and 3 September during the 2008 growing season. Wetland monitoring involved conducting a survey of shrubs and herbaceous plants installed in 2007 as well as a meander survey to identify other plant species present in the restoration area. Photographs taken during monitoring are included as Appendix A.

2.2.1 *Hydrology*

Post-construction topographic elevations were surveyed and found to be generally consistent with the pre-existing wetland area. The restoration area was constructed to afford a subtle negative slope toward the adjacent wetland areas to recreate the pre-existing hydrology. In early spring 2008, standing water was observed in portions of the restoration area. However, based on field observations during the growing season, hydrologic conditions range from surface saturation to saturation 10 inches below ground surface (bgs) depending on the location within the restoration area and seasonal precipitation cycles. In accordance with the Restoration Plan, a silt-clay confining layer was installed below the organic topsoil in the restoration area in order to reduce surface water

infiltration and, based on the 2008 monitoring results; the confining layer is effectively maintaining saturated conditions in the restoration area.

Current hydrologic conditions in the restoration area are consistent with adjacent/downstream wet meadow and scrub-shrub wetlands.

2.2.2 *Soils*

Post restoration soil profiles show the constructed soil surface layers to be approximately 16 inches in depth and consisting of at least 12 inches of sandy loam high in organic matter content. The remaining 4 inches consisted of low-permeability silty-clay soil. The organic topsoil used in the restoration area was manufactured off-Site by Newland Farm of Norton, Massachusetts to ensure the proper organic matter content and that the soil was free of seeds of exotic or invasive species.

Currently, soils in the restoration area are too young in the development of hydric soil morphology to show indicators. However, the frequently saturated nature of these soils during the growing season and high organic content is consistent with the definition of a hydric soil (New England Hydric Soils Technical Committee, 2004).

2.2.3 *Vegetative Cover and Survival of Planted Stock*

On 3 September 2008, ERM collected vegetation data from the restoration area. The 1,545 ft² restoration area is 100 percent vegetated with native, non-invasive species. The data collected on 3 September 2008 indicate that the survivorship of planted herbaceous stock is 100 percent after the first growing season. Table 1 presents a summary of the plants installed in 2007 and the results of the 2008 monitoring for survival of planted stock.

The monitoring procedures also included meander surveys to identify additional plant species present in the restoration area but not specifically planted during the restoration in 2007. These plants are either from the seed mix planted in the restoration area or are native, early colonizers. Table 2 presents a summary of the meander survey results, excluding those species included in the survey of planted stock.

Five species were identified from the original seed mixes planted in the restoration area. Virginia wild rye (*Elymus virginicus*) had the highest areal coverage of this group. It is possible that other species from the seed

mix not encountered during annual monitoring may be present at low population levels.

The restoration area exhibits a diversity of native plant species and the area is expected to continue to naturalize over time. No invasive species were present in the restoration area.

3.0

2008 MONITORING CONCLUSIONS

The project currently meets the criterion established by the OOC (90 percent survival of planted stock) and MWPA (75% coverage of native, wetland species). The hydrologic functions and values of this wetland have been restored. The restoration area exhibits a diversity of native plant species and the area is expected to continue to naturalize over time. No invasive species were present in the restoration area. The restoration area is providing valuable wildlife habitat as a scrub-shrub wetland.

A second year of monitoring will be conducted during the 2009 growing season. A Request for Certificate of Compliance will be submitted to the Commission following that monitoring event.

5.0

REFERENCES

- ERM. 2006a. *Notice of Intent for Remedial Actions in Bordering Vegetated Wetland and the 100-Foot Buffer Zone*. April 26.
- ERM. 2006b. *Restoration Plan, DEP File # 322-0647*. June 14.
- ERM. 2008. *Phase IV – Completion Report, Former Raytheon Facility, 430 Boston Post Road, Wayland, Massachusetts*. December 23.
- New England Hydric Soils Technical Committee. 2004. *Field Indicators for Identifying Hydric Soils in New England, Version 3*.
- Wayland Conservation Commission. 2006. *Order of Conditions and Wayland's Wetlands and Water Resources Bylaw Chapter 194 Permit*. August 8.

Tables

Table 1
Summary of Survival of Wetland Planted Stock
Former Raytheon Facility
Wayland, Massachusetts

| Common Name | Scientific Name | Comments | Number Planted | Number Located in 2008 |
|------------------------|---------------------------|---|----------------|------------------------|
| <i>Planted Species</i> | | | | |
| Pussy Willow | <i>Salix discolor</i> | Planted as proposed | 32 | 32 |
| Meadowsweet | <i>Spiraea latifolia</i> | Planted in place of <i>Spiraea tometosa</i> | 32 | 32 |
| Steeplebush | <i>Spiraea tomentosa</i> | Substitution (<i>Spiraea latifolia</i>) | 0 | 0 |
| Arrow wood | <i>Viburnum dentatum</i> | Planted as proposed | 32 | 32 |
| Silky Dogwood | <i>Cornus amomum</i> | Planted as proposed | 32 | 32 |
| Sensitive Fern | <i>Onoclea sensibilis</i> | Planted as proposed | 350 | 350+ |

| Seed Mix | Name | Application Rate |
|----------------------------|--|----------------------------|
| New England Wetland Plants | Restoration Mix for Detention Basins and Moist Sites | 1 lb/1,250 ft ² |

Notes:

All plants purchased from Bigelow Nurseries, Northborough, MA.
 Steeplebush not available from Bigelow. Species substituted with Meadowsweet (*Spiraea latifolia*).
 lb = Pound.
 ft² = Square feet.

Table 2
Summary of Plant Meander Surveys
Former Raytheon Facility
Wayland, Massachusetts

| Scientific Name | Common Name | Origin |
|----------------------------------|------------------------|--------|
| <i>Panicum rigidulum</i> | Red top | V |
| <i>Epilobium palustre</i> | Willow herb | V |
| <i>Elymus virginicus</i> | Virginia wild rye | S |
| <i>Rumex crispus</i> | Curly dock | V |
| <i>Chamerion angustifolium</i> | Fireweed | V |
| <i>Schizachyrium scoparium</i> | Little Blue Stem | S |
| <i>Erigeron strigosus</i> | Fleabane | V |
| <i>Polygonum hydropiperoides</i> | Swamp smartweed | V |
| <i>Polygonum persicaria</i> | Lady's thumb | V |
| <i>Urtica sp.</i> | Nettle | V |
| <i>Euthamia graminifolia</i> | Grass-leaved goldenrod | S |
| <i>Verbena hastata</i> | Blue vervain | S |
| <i>Dryopteris sp.</i> | Wood fern | V |
| <i>Phleum pratense</i> | Timothy grass | V |
| <i>Convolvulus arvensis</i> | Bindweed | V |
| <i>Rhus typhina</i> | Staghorn sumac | V |
| <i>Cyperus eragrostis</i> | Umbrella sedge | V |
| <i>Polypogon sp.</i> | Rabbit's foot | V |
| <i>Bidens sp.</i> | Beggar's tick | V |
| <i>Coronilla scorpioides</i> | Crownvetch | V |
| <i>Symphotrichum lanceolatum</i> | White panacled aster | V |
| <i>Carex vulpinoidea</i> | Foxtail sedge | S |
| <i>Hordeum jubatum</i> | Squirrel tail grass | V |

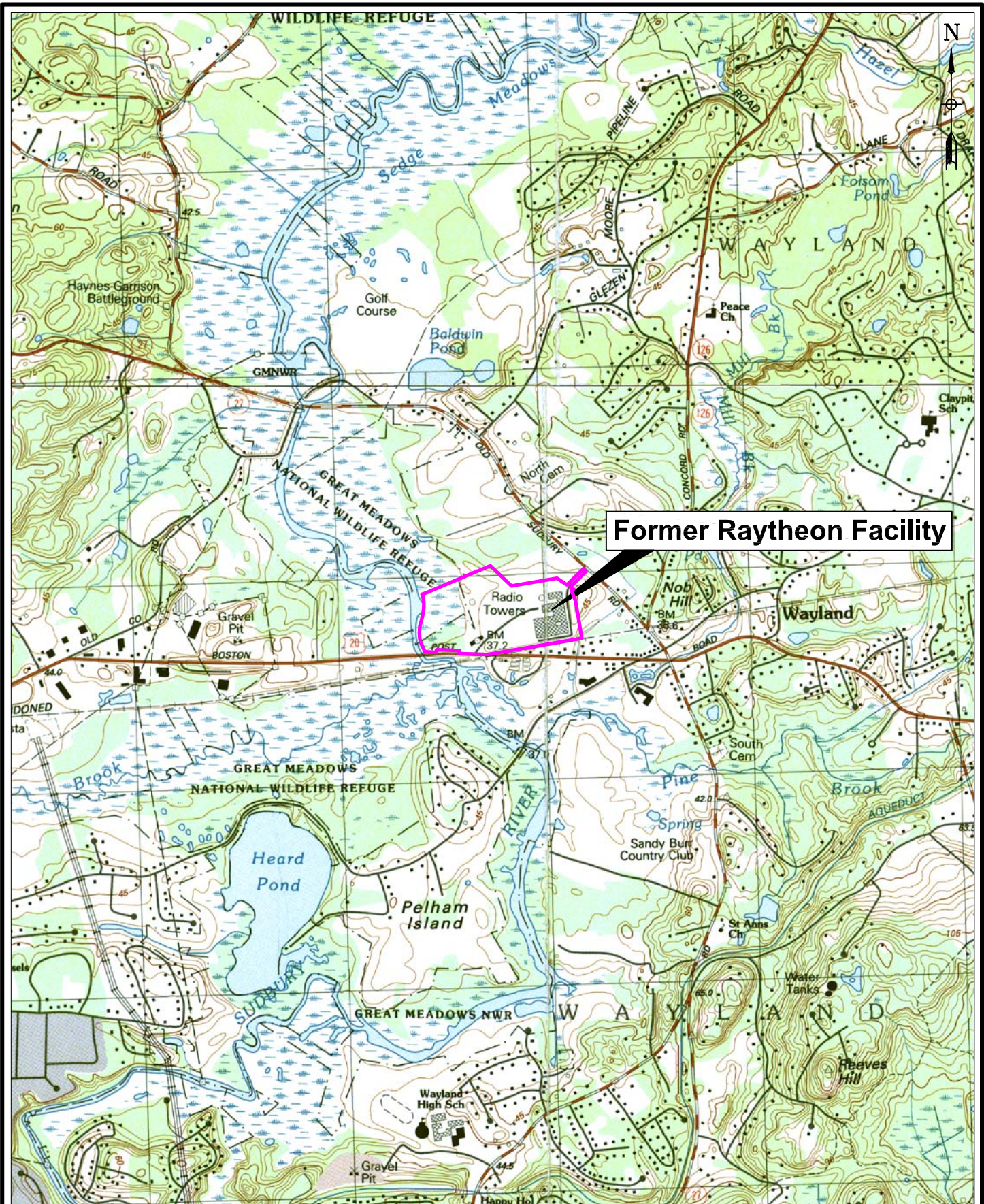
Notes:

S = Seeded.

V = Volunteer/native early colonizer.

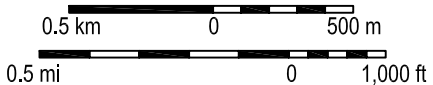
All data collected by ERM on 3 September 2008.

Figures



Former Raytheon Facility

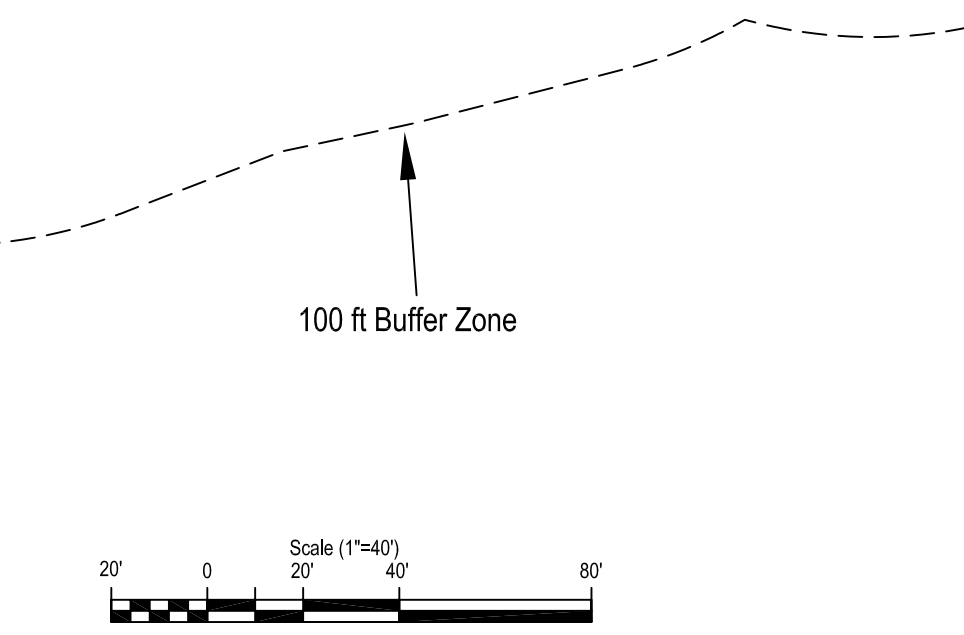
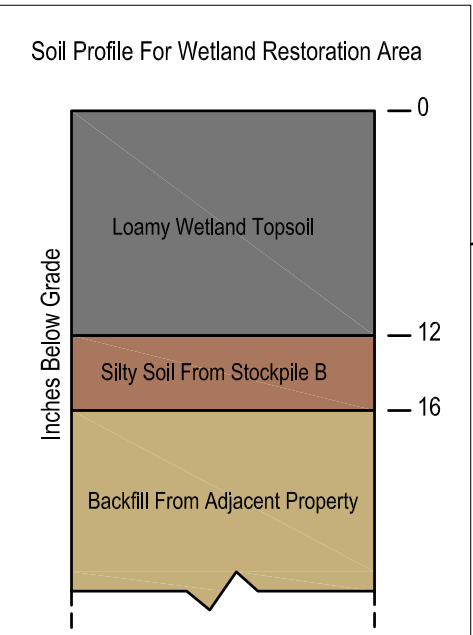
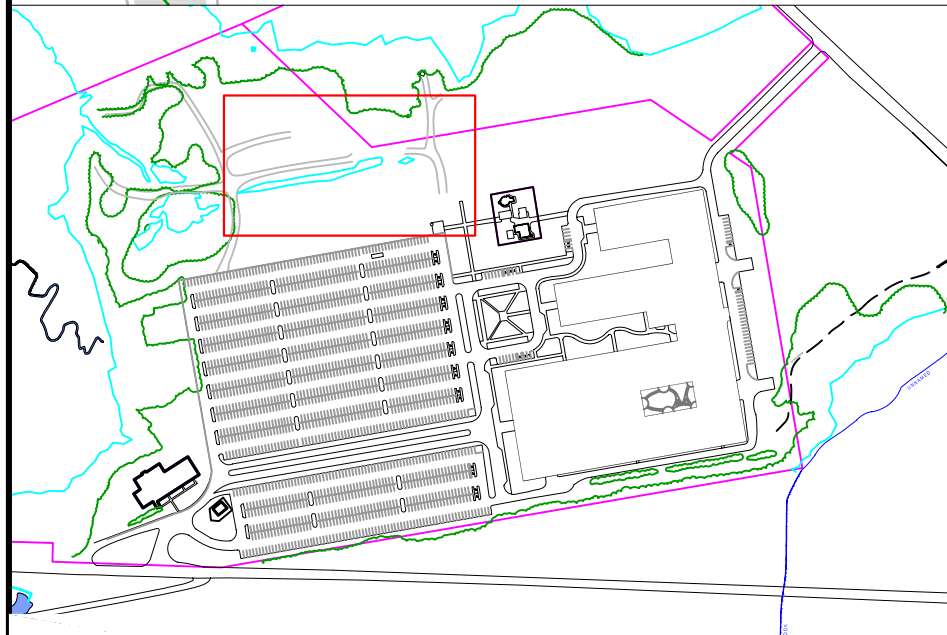
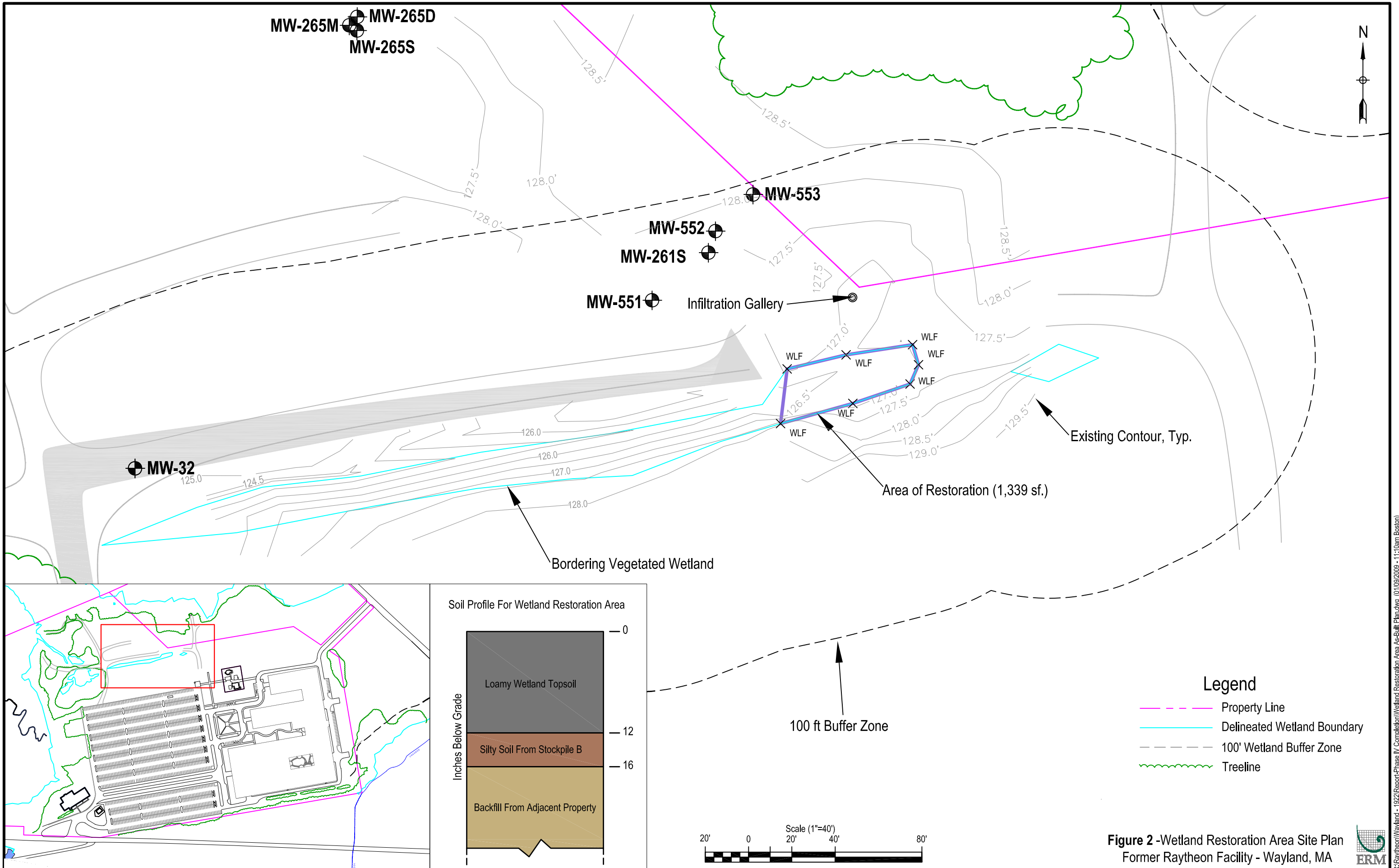
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| | |
|--------|-----------------------|
| Legend | |
| | Subject Property Line |

Figure 1 - Site Locus Map
Former Raytheon Facility - Wayland, MA





- Legend**
- Property Line
 - Delineated Wetland Boundary
 - 100' Wetland Buffer Zone
 - Treeline

Figure 2 -Wetland Restoration Area Site Plan
 Former Raytheon Facility - Wayland, MA



Appendix A
Photographs



Photograph 1 – Restoration Area following installation of plantable topsoil (10/4/07).



Photograph 2 – Restoration Area immediately following installation of plants (10/4/07).



Photograph 3 - Restoration Area looking due west (8/1/08).



Photograph 4 - Restoration Area looking southwest (8/1/08). Note wetland boundary stake at edge of dogwood row.



Photograph 5 - Restoration Area looking northwest (9/3/08). Note dense vegetation.



Photograph 6 - Eastern portion of restoration area looking north (9/3/08).

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